CHAPTER 5. ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter analyzes and compares the effects anticipated under each alternative. The alternatives were developed to address issues, concerns, and opportunities, identified during the planning process (see Chapter 2). Effects from habitat and wildlife management activities and public uses are considered for the following major features of the Gorge Refuges area: (1) physical environment; (2) habitats and associated species; (3) wildlife populations and listed species; (4) public education and recreation; (5) cultural and historic environment; (6) economic environment; and (7) environmental justice. A summary table (Table 5-1) is provided at the end of the chapter to display the effects across the three proposed alternatives.

Under all of the alternatives, the Steigerwald Lake Gateway Center and interpretive trail will be constructed, operated, and maintained. The potential effects of this action were evaluated in a separate Environmental Assessment.[7] The number of visitors anticipated to use the Gateway Center is projected to be between 100,000 and 150,000 per year. Average daily use will be 275 to 400 visitors. The number of visitors using the interpretive trail is estimated at 41,700 per year with an average of 115 visitors per day. On peak days (summer weekends), up to 600 visitors will be expected to come onto the Refuge. Although the Gateway Center and interpretive trail have not yet been built, for the purpose of evaluating the potential environmental effects of actions proposed in this CCP, this level of visitation is assumed to be the existing or baseline condition for public use at Steigerwald Lake Refuge. Furthermore, the CCP/EA adopts by reference, the Steigerwald Lake Gateway Center Finding of No Significant Impact (FONSI) with one exception: alternatives to closing the Columbia River Dike Trail (Dike Trail) to horseback riding, dog walking, jogging, and bike riding are reconsidered. Effects anticipated from these recreational uses of Steigerwald Lake Refuge are evaluated.

The U.S. Army Corps of Engineer's (COE) Steigerwald Lake feasibility study, summary in Appendix H, will identify alternatives for habitat restoration and fish passage that may not have been addressed in the CCP/EA. For example, the study may recommend removal or modification of the elevated channel and reconnection of the Columbia River and Gibbons Creek to the wetlands to restore fish passage. While it is not possible to describe in sufficient detail the possible effects of the alternatives in this CCP/EA, the alternatives are described conceptually in Appendix H. A more complete analysis of alternatives will be evaluated in the feasibility study and associated NEPA document (EA or EIS). If the selected alternative would be a significant change from the approved CCP/EA, the NEPA document for the feasibility study would amend the final CCP/EA for the Gorge Refuges.

Lastly, under all alternatives, Mosquito Control Districts would perform annual

mosquito monitoring and control at Franz Lake Refuge as described in the Compatibility Determination signed by the Service in October 2002. Potential impacts to wetlands and associated species from mosquito control, as well as the impacts anticipated from proposed monitoring and research, were described and evaluated in the Compatibility Determination. The Service provided a 30-day public comment period for the draft Compatibility Determination and issued a Categorical Exclusion and Environmental Action Statement for the final decision.

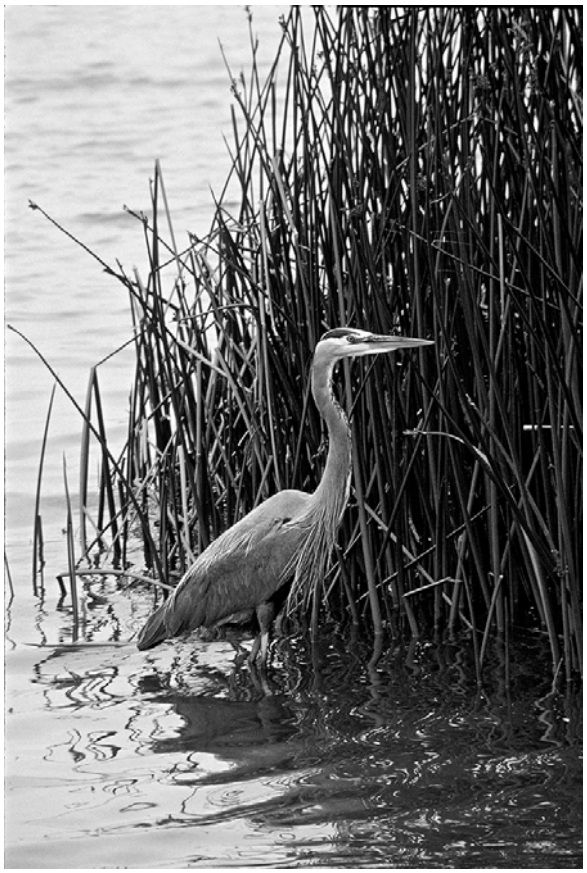
Effects on Physical Environment

Hydrology

Under Alternative A, there would be no change in hydrology from current conditions. Water would be impounded behind existing dikes at depths and hydroperiods designed to suppress the growth of reed canarygrass while providing habitat for native fish and wildlife. In general, this water management regime would consist of holding water from early November through mid- to late-June at a minimum depth of 24 inches, without backing water onto adjacent non-Refuge lands. The high water during the winter and spring growth period of reed canarygrass would reduce its growth and spread. When water is drawn down in June, suitable conditions should exist for moist soil plants to germinate and grow with less competition.

The flood control capacity of the Steigerwald Lake basin would not be affected under any of the alternatives. Construction of a new dike west of the elevated channel in Alternative B would facilitate restoration of riparian scrub-shrub vegetation without measurably affecting flood protection on adjacent private lands. Under unusual winter precipitation patterns, the overflow from Gibbons Creek, spring water, diverted flows from Lawton Creek, and runoff combine to fill the basin. The industrial park managed by the Port of Camas-Washougal is protected from direct flooding of the Columbia River by a dike and a system of pumps and gravity drains that evacuate interior flood waters. In 2000, the COE evaluated the adequacy of the three-pump system and gravity drains for evacuating flood waters during and after intense, long-duration winter storms. The study determined the three pumps provide flooding protection up to the 100-year storm event.[6] However, the loss of one pump would severely reduce the level of flooding protection for the industrial park. Consequently, the Port acquired a fourth pump, not to increase total system capacity, but to provide a safety factor in case of pump failure.

Wetland management guidelines (Appendix M) developed in Alternative B would establish targets for water depths and hydroperiods to ensure the Refuges manage the wetlands for a diversity of native wildlife while reducing the threat of predation from nonnative species. These guidelines would not apply under Alternative C, except at Steigerwald Lake Refuge where water control features would be retained pending results of the COE feasibility study. Under Alternative C, all



Great blue heron. Photo USFWS.

existing water control structures at Pierce and Franz Lake Refuges would be removed, restoring the historic hydrology to the extent possible. Removing the dike from the east end of South Hardy Slough would restore flow-through hydrology more typical of sloughs in the lower Columbia River prior to extensive flood control.

Water Quality

The most pressing water quality issue for the Gorge Refuges is the violation of water quality standards in Gibbons Creek. Pending funding, implementation of Washington State Department of Ecology's Gibbons Creek Water Cleanup Plan over the next 15 years will improve water quality throughout the watershed, including the reach on Steigerwald Lake Refuge. The difference in the alternatives would be seen in the detection and extent of improvement above the baseline condition. Any improvement in water quality is likely to go undetected in Alternative A due to lack of monitoring on the Refuge. Under the other alternatives, water quality monitoring would occur on the Refuges. Also, under Alternatives B and C, increased communication and coordination with agencies and watershed residents, and direct participation in implementing the cleanup plan, would likely accelerate water quality improvements. These improvements would benefit native fish, amphibians, and other aquatic organisms.

Alternatives B and C propose wider riparian buffers than Alternative A. Buffers along streams and around wetlands would provide more effective filtering of sediments, heavy metals, and other contaminants. Riparian vegetation would shade streams and wetlands, reducing water temperatures. Lower water temperatures would benefit fish passage and breeding.

At Pierce Refuge, the bottom of Pierce Lake is composed of fine sediments whose source is currently unknown. Wind and wave action suspend the sediments in the water column, reducing water quality in Pierce Lake. Sediment laden water that flows through the water control structure into Hardy Creek may pose a threat to chum salmon redds downstream from the lake.

Under Alternative A, the water quality of Grenia Creek and Pierce Lake would continue to be unmonitored and siltation

would continue to reduce water quality within Pierce Lake and Hardy Creek. Under Alternative B, water quality monitoring at Pierce Lake would determine the source of turbidity in the lake's outflow. Large woody debris and buffering vegetation would be evaluated as a windbreak to reduce wave action and turbidity. Construction of an improved spillway with splashdown pools would be evaluated to trap sediments before entering Hardy Creek. Improvements to reduce turbidity within Pierce Lake would benefit native amphibians and other aquatic organisms within the wetland. Additionally, reduction of turbidity into Hardy Creek would benefit spawning habitat for chum salmon. Under Alternative C, the Pierce Lake water control structure would be removed and Grenia Creek would be restored to a flow through riverine system. The restored stream may transport sediments downstream, impacting aquatic habitats.

Air Quality

Prescribed burns would be implemented according to the Wildland Fire Management Plan for the Gorge Refuges, see Appendix N. All burning must comply with Washington State's 1995 Smoke Management Plan and be conducted pursuant to a burn plan approved by the State of Washington. Smoke from prescribed burns would have a temporary negative effect on air quality; however, no significant impacts to air quality are anticipated.

Visual Resources

The Gorge Refuges can be viewed from State Route 14, Hamilton Mountain, Beacon Rock, Crown Point, and other scenic overlooks. The Columbia River Gorge National Scenic Area Management Plan requires any new structures proposed within the Scenic Area to be visually subordinate.[8] Proposed changes to the existing infrastructure and many of the proposed habitat improvements may be visible to the public from scenic viewpoints. In Alternatives B and C, construction of a parking area at Pierce Refuge on an already disturbed site would be an aesthetic improvement. Similarly, removal of some existing roads at Pierce Refuge in Alternatives B and C would reduce visual distractions. Under Alternative B, a vault toilet in a color coordinated with Scenic Area staff would be constructed at Pierce Refuge in a site near existing buildings. New interpretive panels at Pierce Refuge and Steigerwald Lake Refuge would be designed to minimize visual distraction while enhancing the visitor experience. In Alternative B, the addition of interpretive signs to an existing city-owned trail along the east boundary of Pierce Refuge would be a minor change. The development of an information kiosk on a section of the Dike Trail adjacent to Stiegerwald Lake Refuge (off-Refuge) in Alternatives B and C, would be a more obvious visual change to the public.

Habitat management actions would result in observable differences to vegetation cover. Some of these changes would be long-lasting or permanent while others would be temporary. Prescribed burns would be used to enhance wildlife habitat through the reduction of invasive plant cover; however, some people may consider the temporarily blackened vegetation resulting from burning to be aesthetically unpleasing. The expanse of open grasslands (mostly managed field)

in Alternative A would eventually give way to forest and riparian scrub, as restoration proposed in Alternatives B and C is completed. Under Alternative C, the sharply-defined boundary between forest and field created by annual mowing would eventually disappear from Pierce Refuge and be much reduced at Steigerwald Lake Refuge. Removal of water control features and conversion of managed field to more natural vegetation under this alternative would markedly reduce the human imprint on the landscape.

Effects on Refuge Habitats and Associated Species

Wetland Complex and Associated Wildlife

Under Alternatives A and B, existing wetland impoundments at Pierce Refuge and Franz Lake Refuge would be maintained. These wetlands currently do not support a desirable emergent plant community because water depths are either too deep or, in the more shallow impoundments, reed canarygrass is too dense. A more diverse community of wetland plants could be produced by reducing the dominance of reed canarygrass.[5] Continuing existing wetland management in Alternative A would result in minor improvements to emergent vegetation. Although the wetlands would continue to provide important habitat for western pond turtle, overall habitat quality would remain low. Under Alternatives B and C, the amount and quality of wetland habitat would be increased, both within and outside wetland impoundments. Alternative B would implement water management, mowing, disking, grazing, and controlled burns. Alternative C would rely primarily on natural regeneration of plants to restore wetland habitats rather than on active planting.

These techniques, applied separately or in various combinations, would have seasonal or short-term impacts to wildlife. In particular, mowing, disking, and flooding could impact ground-nesting birds and western pond turtle. Fires lit during nesting season would reduce nesting cover and may jeopardize annual production of birds. However, the eventual conversion of reed canarygrass dominated wetlands to productive emergent marsh and wet meadow would enhance nesting cover and provide other benefits to native wildlife species.

Under Alternative C, all water control features at Pierce Refuge and Franz Lake Refuge would be removed to restore hydrologic processes (i.e., flow-through hydrology). This action would convert open water and emergent marsh habitat to riverine and wet meadow habitats. Reed canarygrass would proliferate under a regime of shallow, seasonal water a typical feature of wet meadows. Control of reed canarygrass relies on intensive water management which, at the same time, is not conducive to the growth of native meadow plant species. Under Alternative C, soil manipulations (disking, canarygrass removal, herbicide applications) would be applied without the benefit of water management. The long term efficacy of this approach is uncertain. Wet meadow study plots would be established at Steigerwald Lake Refuge under Alternatives B and C to evaluate various techniques for the restoration of these habitats. The most promising results

Swans. Photo copyright Jim Cruce.

would be applied to larger areas of the Gorge Refuges where reed canarygrass is a problem.

Under all alternatives, existing wetland impoundments at Steigerwald Lake Refuge would be maintained pending results of the COE feasibility study. The primary water source for the wetlands would be winter runoff and springs. Due to limitations imposed by the existing system of dikes, water diversions, and flood control requirements, water depths, and hydroperiods on Steigerwald Lake Refuge would not be conducive to native wet meadow restoration, and these areas would continue to support primarily reed canarygrass intermixed with a variety of emergent species. Wetland management guidelines (Appendix M) would ensure water levels are managed to provide a diversity of conditions to the maximum extent possible.

Public use in or near wetlands would be a minor impact under all of the alternatives. Visitors would be required to stay on trails and roads to minimize wildlife disturbance. Seasonal closures would be enforced to protect nesting wildlife. The increase in riparian buffers around wetlands under Alternatives B and C would buffer these areas from human disturbance. Environmental education activities would be allowed only in specified sites that are located away from sensitive areas.

Riparian System and Associated Wildlife

Under Alternative A, restoring minimum-width buffers adjoining salmon bearing waterways would filter sediments, shade the water, and provide a future source of large woody debris. However, habitat patch size, structure, and degree of connectivity would remain inadequate to support most riparian-dependent birds and amphibians, particularly area-sensitive species. Natural succession that is occurring at Pierce Refuge as the result of removing cattle grazing in 1996, would continue to slowly fill in existing riparian forest stands. Forest expansion into adjacent pastures would be largely prevented by grassland management activities, such as mowing and grazing. Without active management, willow stands at Franz Lake Refuge would continue to decline as mature willows die and are not replaced due to the dense ground cover of reed canarygrass within these stands.

Alternatives B and C, in addition to restoring riparian buffers, would create habitat blocks large enough to support area-sensitive species such as yellow-billed cuckoo (extirpated from the lower Columbia River). Larger habitat blocks would reduce nest predators and starlings (competitors for nest cavities). Closing and rehabilitating roads at Pierce Refuge would further reduce habitat fragmentation and may reduce avenues for invasive species introductions.

Improved recruitment of riparian trees and shrubs would restore the diverse age structure and canopy closure required for nesting of yellow warbler, willow flycatcher, Swainson's thrush, and northern harrier. Improved recruitment of Pacific willow at Franz Lake Refuge would secure this habitat. Furthermore, restoration efforts in Alternatives B and C would buffer wetlands and streams and provide wildlife corridors connecting these habitats. Western pond turtle and red-legged frog, in particular, would benefit from improved connections between wetland breeding and upland wintering and summering areas.

A variety of techniques would be employed to restore riparian habitat. Under all of the alternatives, site preparation and planting would have temporary impacts to wildlife. Alternative C would rely more on natural regeneration than on planting to restore native plant composition. Sod and litter would be removed from specific areas to enhance native seed germination and growth. Herbicide use would be less under Alternative C than the other alternatives, possibly reducing potential effects to nontarget organisms. Under Alternative B, the small drainage west of the sewage treatment ponds at Steigerwald Lake Refuge would be recontoured and a water control structure installed to facilitate restoration of scrub-shrub that historically occupied the out-wash apron of Gibbons Creek. Current hydrology is maintaining a dense monoculture of reed canarygrass in this area. Other restoration tools that would be used under all of the alternatives include disking, mowing, herbicide treatments and prescribed fire. These activities would be timed to avoid the breeding season for sensitive wildlife, and additional care would be used in areas known to be occupied by western pond turtle.

Human disturbance from public use would increase in riparian areas under Alternatives B and C. These areas tend to be the focus of environmental education and wildlife viewing activities. The interpretive trail approved in the EA for the Steigerwald Lake Gateway Center is planned to cut through the riparian forest adjoining Redtail Lake.[7] Expansion of the existing forest would reduce the impacts of this trail by widening the riparian corridor. An October to April seasonal closure of a loop along the north side of Gibbons Creek would eliminate the impacts on wintering Canada geese using the grasslands between the trail and Steigerwald Lake, but use of the trail during the May through September period could have a negative impact on nesting birds. Similar increases in the width of riparian areas at Pierce Refuge would provide visual buffers between these habitats and human activities along existing roads and trails. Designating environmental education sites at Pierce Refuge away from sensitive areas (e.g., western pond turtle and Columbia yellowcress habitat and salmon redds) would reduce the potential impacts of these activities to fish and wildlife.

Columbia River Shoreline and Associated Wildlife

Columbia yellowcress is a conservation target for the Gorge Refuges. The population occupying the river's cobblestone shoreline at Pierce Refuge is considered to be the largest remaining population of this State-threatened species in the Columbia River watershed.[2] Despite its relative size, the population is

sufficiently small and geographically restricted to magnify threats to its continued existence.[1,3] Under all the alternatives, the Service would continue to coordinate with The Nature Conservancy to monitor the population. Monitoring would improve current understanding of effects from Bonneville Dam operation on reproduction and population dynamics of Columbia yellowcress and provide data to more accurately assess species viability along the lower Columbia River.[1] In addition, monitoring would better define suitable areas for Columbia yellowcress colonization and artificial propagation. The Refuge would protect suitable habitat from human disturbance by locating public use activities away from the Columbia River shoreline. The Nature Conservancy would continue to remove competing nonnative plants by hand from its property and in cooperation with the Service, from Pierce Refuge. Application of herbicide to cut stems of nonnative false indigo bush would be evaluated on Nature Conservancy property, and would be evaluated in a step-down Integrated Pest Management Plan for Pierce Refuge. The Service would take additional steps in Alternatives B and C to develop agreements, as necessary, with agencies and organizations to coordinate and facilitate improved monitoring, management, and protection of Columbia yellowcress populations and habitat.

Grasslands and Associated Wildlife

Grasslands in the Gorge Refuges can be separated into two types: managed field and old field. Both types occur at Steigerwald Lake and Pierce Refuges. Franz Lake Refuge contains only small areas of old field. Managed fields, as described in the Compatibility Determination in Appendix K, are unirrigated fields maintained in a short-grass condition by mowing, haying, and grazing (Steigerwald Lake Refuge only). Managed fields are fertilized and seeded as needed to maintain a desired species mix for Canada goose forage. Most grasses in managed field are introduced species. Noxious weeds are treated with herbicides. Old fields are areas that were cleared and intensively farmed in the past but have been allowed to develop into tall grasses and other vegetation. Active management of old fields consists of herbicide application to control noxious weeds.

Under Alternative A, the Service would continue to maintain managed fields on about 36 acres at Pierce Refuge and 295 acres at Steigerwald Lake Refuge. Old field would consist of about 96 acres at Pierce Refuge and 105 acres at Steigerwald Lake Refuge. Canada geese would be attracted to these Refuges by the combination of green forage, water, and sanctuary, available from their arrival in fall to their departure in spring. Managed fields would provide an abundance of goose browse, and public use in winter would be directed away from areas heavily used by geese. Goose foraging would be distributed unevenly, with goose use changing by field on a frequent basis. In addition to Canada geese, managed field would be used by great blue herons, northern harriers, and other native wildlife that forage small terrestrial wildlife in low-stature grasslands.

Low native plant diversity in managed fields would reduce their value to most species of native wildlife. Moreover, haying and

A mallard. Photo USFWS.

mowing can negatively impact wildlife by destroying nests, burrows, and tunnels. Haying operations can begin as early as June 15, and some impacts would be unavoidable.

Because the hayed areas are kept in short grass conditions year-round, however, they do not develop the residual cover necessary to attract most species of nesting birds. Old fields would provide suitable alternative habitat for these species. Additionally, old field would provide buffers and movement corridors to adjoining habitats. There would continue to be no effort to restore native grassland plant species to any grassland fields.

The anticipated impacts of grassland management under Alternative B would be similar to Alternative A. In Alternative B, the current amount of managed field would be reduced to areas used by Canada geese. This would be a 13-acre reduction at Pierce Refuge and a 127-acre reduction at Steigerwald Lake Refuge. The amount of old field would also be reduced as restoration of adjacent habitat types is implemented. Managed field would be sufficient to support current levels of use by Canada geese. Most areas receiving little to no use by geese eventually would be restored to oak savanna or riparian forest through natural plant succession and active management. In addition to mowing and grazing, fire would be used in grasslands to maintain goose browse and reduce noxious weeds while reducing the Refuge's dependency on herbicides and mechanical control methods. Late fall growth following fire is anticipated to create favorable goose browse conditions. As opposed to haying and grazing, fire reduces vegetation height while offering a favorable method for nutrient return back to the field. Experimental management of old field would be directed at restoring native plant diversity but this would not be a management priority for the Refuge. Increasing vegetation buffers between grasslands and adjacent wetlands, forest and scrub-shrub would improve habitat for a diversity of native wildlife, protect wildlife from increased levels of human use, and reduce the threat of predation and nest parasitism.

The greatest reduction in managed field would occur under Alternative C. Managed field at Pierce Refuge eventually would be restored to native vegetation. At Steigerwald Lake Refuge, managed field would provide about 138 acres (a 157-acre reduction) of winter browse for Canada geese. This amount of managed field would provide sufficient forage and sanctuary to support current levels of use by Canada geese. Old field would increase at both Refuges. Management of grasslands would be the same as in Alternative B. Eventual elimination of managed field at Pierce

Refuge would be a minor impact to Canada geese, as the Refuge is not a primary

wintering area for the Pacific population of western Canada goose, and naturally occurring areas of short grass would continue to provide sufficient amounts of forage for the several hundred geese that visit the Refuge in a typical winter. Conversion of managed field to riparian forest and oak woodland would restore the historic vegetation and provide habitat for a greater variety of native species, including western pond turtle and neotropical migrant birds.

Under all alternatives, continued public use of the Dike Trail at Steigerwald Lake Refuge would have minor impacts to wildlife using grasslands within visual or auditory range of the trail. Public uses are limited to the dike surface, which is set back from the fields along the extreme south boundary of the Refuge. Primary foraging areas for Canada geese are sufficiently distant from the trail to prevent recurring human disturbance. Further, riparian forest and old field vegetation buffer the managed fields and provide a visual barrier.

Oak Savanna, Oak Woodland, and Associated Wildlife

In Alternative A, the Service would protect but not expand existing oak communities at Steigerwald Lake and Pierce Refuges. Removal of exotic understory vegetation in open canopy oak stands would improve natural regeneration of Oregon white oak and increase native plant diversity. Grazing (Steigerwald Lake Refuge only) and mowing; however, at the interface of oak woodland and managed field would remove oak seedlings and may spread exotic plants. Connectivity of the Steigerwald Lake Refuge oak woodland to Washington State's proposed Washougal Oaks Natural Resources Conservation Area and Natural Area Preserve would be maintained, providing important habitat for conservation targets. Oak savanna, however, would remain in isolated patches too small to provide habitat for conservation targets. There would be temporary disturbance to wildlife from exotic vegetation removal by herbicide spraying and mechanical clearing. Oak woodlands at Pierce Refuge would provide important nesting and overwintering sites for western pond turtle.

In Alternative B, the Service would protect and where appropriate, enhance oak woodlands at Steigerwald Lake and Pierce Refuges. Oak savanna would be expanded at both Refuges to create stands that are large enough to support conservation targets. Removal of exotic understory vegetation would enhance natural regeneration of Oregon white oak and increase native plant diversity within existing stands. Selective removal of sapling conifers (not overstory trees) within oak woodlands would ensure that Oregon white oaks comprise more than 50 percent of the canopy. Periodic low-intensity burns would reduce conifers and nonnative blackberry and facilitate oak germination. Restoration of oak habitat would support ongoing efforts to establish a self-sustaining population of western pond turtles at Pierce Refuge. Short-term, indirect impacts would be reduced by timing activities to avoid the nesting season. Upland areas of known high use by western pond turtles would be evaluated prior to treatment. Unavoidable impacts from controlled burns include smoke, blackened vegetation and some ground disturbance; however, these impacts are short-term and fire is necessary to secure

the long-term viability of oak communities. Impacts from environmental education and other proposed public uses would be reduced by focusing these uses in the least sensitive areas.

Alternative C would use the same suite of management strategies as Alternative B to restore and expand oak communities, but the goal would be to achieve the maximum historic extent and distribution of these communities on the Gorge Refuges. The acres of oak community in Alternative C would be the same as Alternative B at Steigerwald Lake Refuge, but more acres of oak savanna would be created at Pierce Refuge in Alternative C. Through a process of repeated burning and seeding with native plant species, areas currently in managed field would be converted from nonnative grasses to native grasses, then planted to oak seedlings. This process would require many years (over 150 years) to achieve the desired composition and structure of a mature oak savanna. However, successional stages would provide habitat for a wider diversity of native plants and animals than managed field. Lower fuel loads would reduce the potential for hot, uncontrolled fire that could kill mature oaks. Fire impacts would also include smoke and ground disturbance. Controlled burns would be timed to avoid the nesting season. Nesting birds may also be disturbed by seeding and tree planting. Upland areas of known high use by western pond turtles would be evaluated prior to burning. Impacts from environmental education and other public uses proposed in the CCP would be reduced by limiting and focusing these uses in the least sensitive areas.

Impacts of Invasive Species Survey, Monitoring and Control

The Service would increase noxious and invasive plant control efforts under Alternatives B and C. Mechanical, chemical, and biological controls would be used in grasslands and to a lesser extent, in wetland and forested habitats. Judicious use of low intensity fire within these habitats would temporarily reduce dense stands of invasive species such as reed canarygrass and Himalayan blackberry, while paving the way for additional control measures, or by increasing competition by native species. Following approval of the CCP, an Integrated Pest Management (IPM) Plan would be developed to identify specific invasive species control methods, monitoring needs, and the resources required to control target species. The IPM Plan would also describe survey, removal and monitoring techniques for terrestrial and aquatic invasive and nonnative animals. Under all of the CCP alternatives, herbicide application would follow Service Pesticide Use Proposals. Minimum buffer strips would meet or exceed State-mandated standards for all applied herbicides. Applicators would use only a herbicide specifically labeled for the target weed species and in such a manner as to have the least impact to nontarget vegetation.

Exotic wildlife would continue to require periodic control under all alternatives. With Alternatives A and B, existing impoundments would continue to provide breeding habitat for bullfrog, carp, bullhead and nutria. Bullfrogs may eliminate native species of amphibians and reptiles through competition for food resources, aggressive displacement, and predation. Carp would

destroy emergent vegetation and increase turbidity. Nutria would destroy aquatic vegetation and may damage water control structures. Pierce Lake would be drained periodically to remove bullfrog and carp, but the species would eventually reoccupy the lake. Removal of wetland impoundments in Alternative C would reduce bullfrogs, carp, nutria and other nonnative species, at least seasonally. The loss of open water would be detrimental to some native species of wildlife, especially ducks such as scaup, merganser and bufflehead. In particular, removing all water control structures at Pierce Refuge would markedly reduce habitat for western pond turtle and may endanger the reintroduction effort at this site.

At current funding levels (Alternative A), monitoring may be insufficient to detect new invasions of exotic species before they become established on the Gorge Refuges. Alternatives B and C would include intensive surveys and monitoring, not only to measure the efficacy of exotic species control but also to increase the likelihood of detecting new exotic species before they become established. This increase in exotic plant surveys and control would be supported, in part, by partnerships and potential grants. Additionally, volunteers would be invited to assist Refuge staff with exotic plant surveys; mapping infestation and treatment areas; and weed pulling. Public education programs would support these efforts. While increasing public use on the Refuges in Alternatives B and C would increase the amount of ground disturbance and potential for exotic plant introductions, environmental education sites and public use trails would be monitored for nonnative species. Closing road segments at Pierce Refuge would reduce existing avenues for introduction and spread of exotic species.

Impacts of Research and Monitoring

Under Alternatives B and C, the Service would expand its research and monitoring effort, beyond the three or four taxa currently studied, to include study and evaluation of plant and wildlife resources (particularly the conservation targets), natural abiotic and biotic processes, public use impacts, and management options or evaluations for the stated resources. These management-oriented studies would greatly assist the Service in maintaining or restoring trust species and the conservation targets identified in the CCP. Monitoring restoration efforts in wet meadow test plots at Steigerwald Lake Refuge would improve chances for successful and cost efficient habitat restoration. The impacts of research activities would be project and site-specific. Remote or low intensity monitoring is anticipated to have minimal impacts on wildlife and resources. Conversely, some projects may entail the collection of wildlife and plants, require intensive ground surveys or otherwise cause some disruption to wildlife or other resources. Potential disturbance to wildlife would be reduced, in part, by restricting vehicles to designated roads.

Under all of the alternatives, the Service's Columbia River Fisheries Program Office (CRFPO) would continue monitoring adult and juvenile chum salmon in Hardy Creek at Pierce Refuge and in the Ives Island channel. Data collected in these studies would be used to examine factors limiting chum salmon production, enhance and

restore chum salmon production, and evaluate the relations between chum salmon spawning in the Columbia River and tributary streams. Abundance of adult chum salmon would be estimated using a trap and weir and conducting carcass surveys. Abundance of juveniles would be estimated using traps. Adults fitted with radio tags would be used to determine fish movements. Possible impacts associated with this project include catching nontarget organisms, human disturbance at the weir site and on Refuge roads, and periodic removal of beaver dams constructed at the weir.

The level of research effort would be similar in Alternatives B and C, but the establishment of the Franz Lake Research Natural Area in Alternative C would formally recognize the importance of the Refuge as a baseline for research and may increase interest within the scientific and academic community to conduct management-oriented research at this Refuge. Activities on the RNA would be limited to research, study, observation, monitoring, and educational activities that are non-destructive, non-manipulative, and maintain unmodified conditions (Service Manual 8 RM 10.2). Management practices may include grazing, control of excessive animal populations, prescribed burning, and the use of chemicals for plant, insect, and disease control (Service Manual 8 RM 10.8). Generally, permanent physical improvements such as roads, trails, viewing platforms, permanent buildings and structures are not permitted within natural areas. However, temporary facilities needed for research, such as instruments or personnel shelters, may be installed with the approval of the Refuge Manager. In all cases, these structures would be removed and the area restored to its original state upon conclusion of a research project (Service Manual 8 RM 10.8 D).

Effects on Wildlife and Plant Populations Including Listed Species

Anadromous Fish

Under all of the alternatives, vegetation buffers along salmon-bearing streams would benefit anadromous fish by shading the water, stabilizing streambanks, contributing large woody debris and organic litter, filtering sediments and potential contaminants (including herbicides), and providing a source of food for aquatic invertebrates. Removal of physical barriers to fish migration (e.g., elevated culverts) would improve access to nesting and rearing areas. Alternative A would remove fish migration barriers within Refuge boundaries except existing water control structures. Migration barriers immediately upstream of the Refuges may continue to block access. Under Alternative B, the Service would monitor water quality entering Hardy Creek from Pierce Lake and evaluate options to improve water quality at the outflow of Pierce Lake segments of Hardy Creek supporting chum salmon redds. Under Alternatives B and C, the Service would work with other agencies and private landowners to remove these barriers, as well. Refuge water control structures would be removed in Alternative C, providing native and nonnative fish with access to historic riverine habitat. Also under Alternative C, the feasibility of reconnecting South Hardy Slough in Pierce Refuge to Hamilton Slough would be investigated.

Removing the soil plug at the head of the slough would improve fish access and water quality in the slough. However, juvenile salmonids may become stranded in the slough when river water levels subside, and silt transported into the slough may smother redds.

Federally-listed species of fish known to occur on or within the vicinity of the Gorge Refuges include chinook salmon, chum salmon, coho salmon (candidate), and steelhead. Additionally, proposed Critical Habitat for bull trout occurs on all three Refuges. The Service would continue to monitor chum salmon at Pierce Refuge and would inventory listed salmonids at Franz Lake Refuge. Water quality improvements would benefit listed species of fish. Road closures proposed at Pierce Refuge under Alternatives B and C would reduce soil erosion, benefitting chum salmon spawning in Hardy Creek. Under all alternatives, the Steigerwald Lake feasibility study may identify projects to restore chum salmon access to the historic lakebed and side channels. Implementation of these projects would be evaluated in a separate NEPA document.

Western Pond Turtle

Western pond turtle is a State-endangered species. Under all of the alternatives, the Service and Washington Department of Fish and Wildlife (WDFW) would continue to work cooperatively to establish a self-sustaining population of 200 western pond turtles at Pierce Refuge, as described in the existing agreement. The full success of this introduction effort will not be known for approximately 10 years, when the first turtles released mature enough to reproduce. Establishment of a self-sustaining population of western pond turtles at Pierce Refuge would help meet the State's recovery objectives for the species. Downlisting is an official recognition of greater security in the future of the species, which is the ultimate goal of any species recovery program. Rebuilding the pond turtle population in Washington State would have the added benefit of offsetting the need or likelihood of a federal listing. By taking steps to stabilize and reestablish this species before federal listing is necessary, increased restrictions on management of private land having western pond turtles and suitable habitat can be avoided.

Possible effects to Refuge habitats and other species from the first two years of pond turtle releases (2000 and 2001) were evaluated in a separate EA signed by the Service in 2000. These effects are anticipated to continue throughout the release program. Introduced western pond turtle may compete with the resident western painted turtle population but the species are anticipated to co-exist, as they do in other sites in Washington. Some pond turtles may wander onto the adjacent golf course, but a population is not likely to become established at this off-Refuge site. Pond turtles are not a threat to federally-listed species or any other special status species know to occur on the Refuge. Vehicle traffic on the Refuge would increase during turtle releases and monitoring each spring and summer. Vehicles would use existing designated roads. All of the telemetry would be done on foot or from a canoe or kayak.

Pierce Refuge was selected for the establishment of a third population of western pond turtle in the Columbia River Gorge, because it meets criteria established by the WDFW for turtle release sites. Specifically, the Refuge contains a complex of small ponds with abundant basking sites which are isolated from public roads and other centers of human activity and large bodies of water and streams. Refuge wetlands contain emergent vegetation, a mud bottom, and abundant invertebrate and larval amphibian prey. Additionally, Pierce Refuge contains a diversity of upland habitats, including open, grassy areas for nesting and dense clumps of deciduous trees or shrubs for overwintering. Under Alternative A, the diverse complex of ponds, wetlands, and grasslands would be retained. Managed fields would provide short grass conditions viable for western pond turtle nesting. Emergent vegetation would be maintained through water management and a limited amount of disking. Predators of western pond turtles would be removed periodically from Pierce Lake by draining it. While these management activities would have the potential to injure turtles, they would be timed to avoid periods of peak use by turtles. Public use, particularly environmental education, would increase, but activities would only be permitted in areas during specific times of the year when disturbance to turtles is not detrimental.

Under Alternative B, lakes and ponds also would be retained. Pierce Lake would be drained periodically to remove bullfrogs and other turtle predators. A reduction in deep water habitat and increase in shallow emergent marsh habitat would reduce the suitability for bullfrogs within Lena's Lake. Proposed increases in emergent marsh, riparian and oak habitat would benefit western pond turtle. Managed field (potential nesting habitat for western pond turtle) would be restored to other suitable cover for nesting and overwintering (i.e., oak savanna and riparian forest). Fire would be used to enhance native vegetation. Vehicles used to conduct burns would be restricted to areas unlikely to be occupied by turtles. These activities would be coordinated to avoid turtle nesting and movement corridors to the maximum extent possible. Western pond turtle nests would be protected if necessary to improve hatchling survival until the reintroduction objective has been achieved. Closing unnecessary roads would reduce the chance of turtle casualties. The expanded environmental education program would increase public interest in turtles with possible benefits to turtle conservation. Some disturbance of turtles by Refuge staff, teachers, students, and researchers is likely to occur but it would be infrequent and of short duration.

Alternative C would have the greatest potential to negatively affect western pond turtle. The turtles are mostly aquatic April through September. They forage in freshwater ponds, and are sometimes found in rivers and lakes.[4] Removing all water control structures at Pierce Refuge would drain wetlands and reduce permanent wetland habitat available for turtles. This could also have a negative impact on the prey base and forage vegetation for turtles. Competition for limited resources may increase between native painted turtles and reintroduced western pond turtles. Without the water control structures, the risk of extirpation for western pond turtle, and

possibly painted turtle, would increase. Despite these potential negative impacts, removing man-made ponds and lakes would benefit turtles by reducing (but not eliminating year-round) nonnative predators. Further, eliminating managed field would reduce nesting habitat, but it would also reduce turtle casualties caused by equipment.

Bald Eagle

Under Alternative A, no monitoring of bald eagle nesting at the Refuges would occur. Management actions in Alternative A would not impact bald eagle wintering and nesting; however, ongoing ecological processes (riverbank erosion, plant succession) may reduce availability of roost and nest trees. Under all alternatives, public use would continue to be diverted away from bald eagle nesting areas. A minor increase in public use under Alternatives B and C may increase disturbance to bald eagles but staff-led programs would minimize or avoid the disturbance. Proposed guided kayak tours of Franz Lake would have only a minor, temporary disturbance to fish and wildlife, as paddlers would not be allowed to leave their boats. Road closures at Pierce Refuge proposed under Alternatives B and C would reduce possible disturbance to bald eagles attempting to nest on the Refuge.

Effects on Public Education and Recreation

Opportunities for Wildlife Observation and Photography

The vast majority of wildlife viewing on the Gorge Refuges would occur with construction of the approved Gateway Center and interpretive trail at Steigerwald Lake Refuge. Anticipated effects resulting from these activities were explained in the Environmental Assessment (FWS 1999). The interpretive trail from the center will follow the toe of the elevated Gibbons Creek channel south, across the creek under a riparian canopy, and connect to the Dike Trail. A seasonal loop will branch off from the south end of the elevated channel portion of Gibbons Creek and follow a riparian area on the north side of the natural part of the creek, then join the year-round portion of the trail on the dike. The length of the trail will be just over two miles. To improve wildlife observation and photographic opportunities, construction plans for the center and trails include restoration and enhancement of native vegetation and wetland habitats. The wildlife associated with these areas are several species of waterfowl including Canada geese and ducks, wading and shorebirds, raptors, some species of fish in the creek channel, and a colony of purple martins that use nesting gourds placed along the Dike Trail by Refuge staff and volunteers during the nesting season.

Under Alternative A, the interpretive trail at Steigerwald Lake Refuge would be officially closed to horses, dogs, joggers, and bikes. Closing the interpretive trail to these non-wildlife-dependent uses would improve the quality of wildlife viewing, increase safety and reduce crowding. Additionally, the Service would offer occasional guided tours to view Steigerwald Lake from the Straub Dike. Existing opportunities for wildlife viewing and photography at Pierce Refuge and Franz Lake Refuge would remain unchanged

under Alternative A. Refuge staff would continue to offer guided tours of these Refuges for organized groups. Staff-led tours at Pierce Refuge would rarely exceed 5 per year; average attendance would be about 30 visitors per tour. Tour groups would be required to remain on existing roads. Staff-led tours at Franz Lake Refuge would be more limited in number and size. By limiting public use of Pierce Refuge and Franz Lake Refuge, the Service would provide a unique wildlife viewing opportunity for small groups with minimal disturbance to the resources.

Under Alternative B, there would be a moderate increase in staff- and volunteer-led tours at Steigerwald Lake and Pierce Refuges. Visitors would have access to specific areas of these Refuges where they could observe oak, wetland, and riparian habitat and associated wildlife. The Dike Trail would remain open to walking, horseback riding, dog walking, and bicycling. Dogs may disturb wildlife, particularly if they are unrestrained. Overall, the quality of wildlife viewing on the Dike Trail may be reduced by potential conflicts between horses, dogs, and bikes. Group tours of Pierce Refuge would be encouraged from March through June; attendance would be limited to 40 to 60 people per tour, one tour per day, and no more than two tours per week. A parking area and vault toilets would be constructed to accommodate the increased use. In addition, the Service would offer wildlife and photography viewing during special events such as National Wildlife Refuge Week, National Migratory Bird Day and the Lewis and Clark Bicentennial. A Special Use Permit may be issued to groups and individuals to allow occasional, unguided use of Pierce Refuge. The public would also be primarily encouraged to view wildlife from the existing, paved trail located off-Refuge along the east boundary of Pierce Refuge (from the town of North Bonneville).

Under Alternative B, a rare opportunity for the public to access Franz Lake Refuge from the Columbia River would be provided through guided kayak tours. Boats would put in at U.S. Forest Service's Saint Cloud Recreational Area, paddle upstream to the mouth of Arthur Lake, and, if water levels allow, enter the lake, crossing Forest Service property. Kayaks would not be allowed upstream of the existing beaver dam. Tours would be led by a Service-approved guide and limited to no more than 10 kayaks. Tours would be offered between May 1 and October to avoid wildlife disturbance. This unique opportunity would support the Lower Columbia River Water Trail currently being proposed by the Lower Columbia River Estuary Partnership.

Opportunities for wildlife viewing and photography under Alternative C would be similar to Alternative B, although fewer staff- and volunteer-led tours would be offered. Dogs on Dike Trail would continue to disturb wildlife and impact wildlife viewing. Kayak tours of Franz Lake would provide the only public access to this Refuge, although visitors could continue to view it from the existing overlook on State Route 14.

Opportunities for Wildlife Interpretation

Under all of the alternatives, implementation of the Steigerwald Lake Gateway Center and interpretive trail would substantially

increase opportunities for wildlife interpretation. Anticipated effects resulting from these activities were explained in the Environmental Assessment and FONSI (FWS 1999). Facilities planned for the Gateway Center include a visitor center complete with static and interactive displays and information panels, an outdoor interpretive kiosk with a viewing platform, spotting scopes, restrooms, brochures and other written literature, audio visual programs, indoor classroom space and equipment, and a bookstore. The visitor center, kiosk, and trail will include interpretive exhibits that communicate to the Refuge visitor key messages, as well as provide tourist information about the Scenic Area.

Under all three alternatives, Refuge visitation is anticipated to increase with development of the Captain William Clark Park at Cottonwood Beach. In cooperation with the Port of Camas/Washougal and Clark County Parks Department, the Service would develop an entry sign and information kiosk on the Dike Trail at the entrance to Steigerwald Lake Refuge. Information and interpretation provided at the kiosk would increase public understanding of Refuge goals and management among traditional and non-traditional Refuge user groups. Additionally, under Alternatives B and C the Service would investigate the feasibility of improving the existing Steigerwald overlook on State Route 14. Refuge staff leading guided tours onto Franz Lake Refuge would provide interpretation. An information kiosk would be placed at Pierce Refuge to increase visitor's understanding of the Refuge.

Opportunities for Environmental Education

Under all of the alternatives, the Steigerwald Gateway Center and interpretive trail will provide a high quality learning environment for students and teachers. Educators will have access to an indoor classroom at the Center, and Refuge staff and volunteers will provide educational services year-round. Opportunities for environmental education at Pierce Refuge under Alternative A would remain limited. The Service would authorize non-Service organizations and Service programs (e.g., CRFPO) to conduct education programs on the Refuge under a Special Use Permit. Interest in using the Refuge for educational activities would be sporadic; maximum use would be 180 students per year, but in some years no educational activities would occur on the Refuge. Because the Refuge would be minimally involved in environmental education at Pierce Refuge, key Refuge "messages" would not be communicated consistently to students and teachers

Under Alternatives B and C, the Service would establish an environmental education program for the Gorge Refuges in cooperation with volunteers and partners. It would target local schools, with Refuge staff visiting schools under Alternative B but not under Alternative C. Under Alternatives B and C, environmental education sites would be selected on Pierce and Steigerwald Lake Refuges for their teaching value and ability to withstand human disturbance. A site-design plan would be developed for Pierce Refuge under Alternative B to assess environmental education facility needs and restroom, parking area and all-weather shelter placement.

Opportunities for Compatible, Non-Wildlife-Dependent Uses of Columbia River Dike Trail

The Dike Trail on Steigerwald Lake Refuge is used unofficially for walking, jogging, dog walking, bike riding, and horseback riding. Additionally, anglers use the dike to access fishing sites located off the Refuge (below mean-high water). Under Alternative A, the Service would implement the decision it made in 1999 to close the east-half of the Dike Trail on Steigerwald Lake Refuge to all uses except walking.[7] The closure would go into effect when the previously approved interpretive trail is developed. Anglers would not be affected. Current users affected by the closure would be equestrians, dog walkers, bicyclists, and joggers. Among these user groups, equestrians would be the most affected, particularly during winter when alternative low-elevation trails are frequently too wet for riding. Moreover, should the Service acquire private inholdings at the east end of the trail, equestrians and bicyclists would be prevented from using the dike to connect to U.S. Forest Service trails in the National Scenic Area.

The trail restrictions would not be implemented under Alternatives B and C. There would be no change in opportunities for horseback riding, dog walking, jogging and bicycling on Steigerwald Lake Refuge. These would be compatible uses of the Refuge under stipulations enumerated in the Compatibility Determination (Appendix K). Allowing non-wildlife-dependent uses of the Dike Trail to continue would provide the Service with an opportunity to communicate key Refuge messages to non-traditional Refuge users. Although no accidents involving horses, dogs, or bikes on the Dike Trail have been reported to the Service or Port of Camas/Washougal, conflicts are more likely to occur between these user groups in the future under Alternatives B and C than under Alternative A. The number of horses and bikes using the Dike Trail would likely increase in the next 15 years, especially with full implementation of the proposed Captain William Clark Park at Cottonwood Beach. However, the number of horses on the trail at one time would continue to be controlled by the size of the existing horse trailer parking lot on Port of Camas/Washougal property. The Port currently has no plans to enlarge the facility. Although the parking lot can accommodate up to 15 trailers (30 or more horses), based on current estimated use, the actual number of horses on the Dike Trail would range from two to eight, except during a special group event. Organized groups of 10 to 15 horses would be required to obtain a Special Use Permit from the Refuge. Groups larger than 15 would not be permitted on the Refuge's section of the Dike Trail. Signs on the trail and information in the kiosk at the entrance to the Refuge would explain appropriate and safe use of multiple-use trails.

Effects on Cultural and Historic Environment

Under all alternatives, the potential for any given project to affect prehistoric and historic resources and Native American cultural artifacts would be determined early in the planning phase of a project. Consultations would occur with the Washington State Office of Archaeology and Historic Preservation for all proposed

projects that may impact cultural resources. Appropriate steps would be taken to preserve and protect all identified cultural resource sites. The procedures in 36 CFR 800 implementing Section 106 of the National Historic Preservation Act, requirements of the Native American Graves Protection and Repatriation Act, and policies and standards specified in the Fish and Wildlife Service Manual 614 FW 1-5 would be followed in all cases. Additionally, the Wildland Fire Management Plan for the Gorge Refuges (Appendix N) identifies specific actions that would be taken to protect cultural resources.

Alternative B identifies key messages to communicate to Refuge visitors about Native American life-ways and early Euro-American settlement. Specifically, these messages include: (1) fish resource use from the Wah-cleh-lah village to fishwheels; (2) native American plant resources such as wapato at Franz and other important plants for food, shelter, canoes, and clothing; and (3) early Euro-American settlers. Increasing the Environmental Education program in Alternatives B and C would expand existing opportunities to communicate these messages.

Economic Effects

The Gorge Refuges are currently staffed with one full-time employee. The minimum level of staffing needed for the Gorge Refuges to provide only the most essential services (i.e., "essential staff") includes four additional permanent full time staff and one full-time term person. None of these positions are currently funded. Moreover, essential staff alone would not be sufficient to allow the Refuges to fulfill their refuge purposes. Under Alternative B, the Service would need to add three permanent full-time staff, one permanent part time staff, and three temporary-seasonal positions to the essential staff over the next 15 years. Additional staff needed to manage the Gorge Refuges would likely reside in local communities. In addition, construction of the Steigerwald Lake Gateway Center would benefit the local economy if Refuge visitors patronized local businesses.

Effects to Environmental Justice

Executive Order 12898 requires all federal agencies to analyze environmental effects on minority populations and low-income populations. Income levels in Skamania County have been below the State average since the early 1980s (see Table 4-13). The environmental education program proposed for Pierce Refuge in alternatives B and C would target Skamania County schools. Opportunities for minority or low-income populations to visit the Gorge Refuges for approved public uses would continue or would be expanded under alternatives B and C. Existing public uses of the Columbia Dike Trail at Steigerwald Lake Refuge would continue for a wide-variety of populations. Additionally, the needs and interests of Indian Tribes and minority populations would be considered in the planning and content design for the Steigerwald Lake Gateway Center and interpretive trail.

Table 5-1. Summary of environmental consequences of the alternatives. (SLR: Steigerwald Lake Refuge; FLR: Franz Lake Refuge; PR: Pierce Refuge).

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
Effects on Physical Environment			
Hydrology	No change from current conditions	Improved water management to support greater wildlife diversity, while reducing predation by nonnative species	Return impoundments and Hardy Slough (PR) to flow-through hydrology
Water Quality	• Minimum width riparian buffers filter and shade streams/wetlands • Elevated water temperatures within impoundments	• Wide riparian buffers filter and shade streams/wetlands • Elevated water temperatures within wetland impoundments • Refuge wetlands receive less sediments and pollutants from Gibbons Creek on SLR • Accelerate Gibbons Creek Water Cleanup Plan benefits water quality on SLR • Improved water quality in Pierce Lake and Hardy Creek at PR resulting from vegetation buffers and sediment traps	• Wide riparian buffers filter and shade streams/wetlands • Fewer wetland impoundments • Refuge wetlands receive less sediments and pollutants from Gibbons Creek • Accelerate Gibbons Creek Water Cleanup Plan benefits water quality on SLR
Visual Resources	• No change in appearance from scenic overlooks	• More tree/shrub cover, less pasture • Enhance existing facilities and close some roads at PR would reduce human imprint • Prescribed fire to enhance habitat temporarily blackens ground	• More natural landscape with removal of dikes, pastures • Enhance existing facilities and close some roads at PR would reduce human imprint • Prescribed fire to enhance habitat temporarily blackens ground

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
Effects on Refuge Habitats and Species			
Wetlands	• Low native wetland plant diversity; no wetland restoration outside impoundments; no native wet meadow restoration. • Open water would provide habitat for western pond turtle but water control structures deny access to anadromous fish • Mowing, plowing, fire and grazing would have seasonal impacts to ground-nesting birds and western pond turtle • Low level of human disturbance to wildlife from public uses.	• Expanded effort to restore wetland plant diversity within and outside impoundments; experimental wet meadow restoration • Mowing, plowing, fire and grazing would have seasonal impacts to ground-nesting birds and western pond turtle • Avoidance and riparian buffers would protect wetlands from moderate increase in public use.	• Return wetlands and open water to riverine/wet meadow; reed canarygrass would likely increase. • Removing impoundments on PR would reduce or eliminate pond turtle; increase habitat for anadromous fish; reduce bullfrog and carp • Mowing, plowing, fire and grazing would have seasonal impacts to ground-nesting birds and western pond turtle; herbicide use reduced • Avoidance and riparian buffers would protect wetlands from minor increase in public use.
Riparian System	• Vegetation buffers would protect salmon-bearing streams but most forest stands would be incapable of supporting area-sensitive species. • Expansion of stands into adjacent pasture largely prevented • Pacific willow at FLR would eventually be displaced by reed canarygrass • Scrub-shrub habitat inadequate to support most riparian-dependent birds • Restoration activities would have temporary impacts to wildlife	• Habitat would support area-sensitive species; buffer wetlands/streams; and provide wildlife movement corridors • Forest stand structure would improve; nesting habitat for neotropical migrants • Improved recruitment of Pacific willow at FLR would restore this habitat for native species • Scrub-shrub habitat would support yellow warbler, willow flycatcher and northern harrier • Restoration activities would have temporary impacts to wildlife • Environmental Education in designated site at PR	• Same as Alt. B, except use of herbicides may be reduced or eliminated.

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
Columbia River Shoreline	• yellowcress monitoring would detect population trends and assess species viability • Protect habitat from trampling	• Refuge would take more active role in Rorippa management; competitive plant removal • Protect habitat from trampling	• Same impacts to yellowcress as in Alternative B
Grasslands	• No change in grassland acres • Mow, burn, graze (SLR only), fertilize, and seed to maintain goose browse; avoid nesting season • Old field provide habitat, movement corridors, and buffers • Use fire and herbicides on noxious weeds. • Low native plant diversity and natural succession impeded in managed field	• Grassland acres reduced; current level of goose use supported; benefit pond turtle nesting • Experiment with native plant restoration in old field. • Use fire and herbicides on noxious weeds. • Low native plant diversity and natural succession impeded in managed field	• Maximum reduction of managed field; current level of goose use supported; benefit pond turtle nesting • Experiment with native plant restoration in old field. • Use fire and herbicides on noxious weeds. • Low native plant diversity and natural succession impeded in managed field
Oak Woodland and Oak Savanna	• Oak savanna habitat too small to support conservation targets • Protect size and connectivity of oak woodlands for western pond turtle and white breasted nuthatch • Natural regeneration of oaks would be minimally improved with exotic vegetation removal but grazing and mowing of adjacent grasslands would suppress oak regeneration. • Vegetation management would have temporary impacts to wildlife and visual resources	• Oak savanna habitat expanded to support conservation targets • Protect size and connectivity of oak woodlands for western pond turtle and white breasted nuthatch • Stand structure and understory composition would be improved with controlled burns and mechanical removal of exotic vegetation and sapling conifers • Controlled burns and vegetation management would have temporary impact to wildlife and visual resources	• Oak savanna habitat expanded to support conservation targets • Protect size and connectivity of oak woodlands for western pond turtle and white breasted nuthatch • Stand structure and understory composition would be improved primarily with controlled burns • Controlled burns and vegetation management would have temporary impact to wildlife and visual resources
Invasive Species	• Focus on noxious weed control; invasive species persist and may spread to previously uninfested areas • Surveillance would be	• More aggressive effort to contain and reduce extent of exotic species • Increased surveillance and rapid response to new	• Effects similar to Alt. B but habitat for bullfrogs, carp, and nutria would be greatly reduced

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
	inadequate to detect new invasions which could become difficult to control • Bullfrog, carp, bullhead, and nutria may reduce or eliminate native species despite periodic control	invasions would increase effectiveness of control • Bullfrog, carp, bullhead, and nutria may reduce or eliminate native species despite periodic control • Fire and herbicides may impact wildlife in short-term but reduce exotics • Public education and road closures would support control efforts	
Research and Monitoring	• Very limited monitoring; most Refuge information needs would remain unmet • Lack of monitoring would increase the likelihood of failed or marginal efforts to restore native habitats • Refuges remain relatively unknown to scientific community • Impact from public uses would not be monitored	• Greatly improved understanding of Refuge conservation targets and their response to management • Adaptive management would increase likelihood of successful, cost efficient habitat restoration. • High priority research projects for the Refuge would be accomplished • Disturbance from scientists would be monitored and corrective action taken	• Effects would be similar to Alt. B but establishment of the Franz Lake Research Natural Area would highlight the importance of the area and increase interest within the scientific and academic community to conduct more research that could benefit floodplain habitat protection and restoration
Effects on Wildlife Populations and Listed Species			
Anadromous Fish	• Riparian buffers would protect native fish habitat. • Removal of fish migration barriers within Refuge streams would improve access to on-Refuge habitat • Water control structures would block access to historic habitat but prevent native fish entrapment, predation, and delayed migration	• Riparian buffers would protect native fish habitat. • Fish habitat improvement projects throughout watersheds would provide access to more habitat • Water control structures would block access to historic habitat but prevent native fish entrapment, predation, and delayed migration • Improved coordination would increase effective fisheries management	• Riparian buffers would protect native fish habitat. • Fish habitat improvement projects throughout watersheds would provide access to more habitat • Removal of impoundments and South slough plug (PR) would restore fish access but may strand native fish and silt redds • Improved coordination would increase effective fisheries management

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
Western Pond Turtle Management at PR	• No change in habitat conditions that make this Refuge a suitable release site for western pond turtle. • Periodic removal of turtle predators from Pierce Lake • Grassland management would maintain nesting habitat but may injure turtles • Habitat management coordinated to avoid turtle nesting and movement corridors to extent possible • Public use impacts reduced by directing activities away from turtles	• Positive effect from increase in emergent, riparian and oak savanna habitat • Periodic removal of turtle predators from Pierce Lake • Habitat management coordinated to avoid turtle nesting and movement corridors to extent possible • Public education/outreach would increase interest in turtle conservation; Refuge-led tours would reduce likelihood of disturbance. • Closing unnecessary roads would reduce chance of turtle casualties	• Loss of open water and permanent wetlands would be detrimental to turtles (pond and painted) • Removing all water control structures would reduce predators of juvenile turtles • Habitat management coordinated to avoid turtle nesting and movement corridors to extent possible • Public education/outreach would increase interest in turtle conservation; Refuge-led tours would reduce likelihood of disturbance. • Closing unnecessary roads would reduce chance of turtle casualties
Threatened and Endangered Species	• No monitoring of bald eagles; survey and monitoring of salmonids would continue • Bald eagle would not be impacted by management but habitat suitability may naturally decline • Water quality improvements and removal of fish migration barriers on-Refuge would benefit listed species • Public use would be diverted away from bald eagle nesting areas and salmon-bearing streams	• Increase inventory and monitoring of listed species, including bald eagle and listed fish • Habitat management and road closures would improve and increase habitat for listed species • Water quality improvements and removal of fish migration barriers in Refuge watersheds would benefit listed species • Public use would be diverted away from bald eagle nesting areas and salmon-bearing streams; guided kayak tours of Franz Lake would cause minor, temporary disturbance	• Potential impacts similar to Alt. B.
Public Education and Recreation			
Opportunities for Wildlife Observation and Photography	• Occasional staff-led tours on Straub Dike (SLR) and at PR would provide a unique viewing opportunity for small groups	• Moderate increase in staff- and volunteer-led tours at SLR and PR • Dogs on Dike Trail continue to disturb wildlife	• Minimal increase in staff- and volunteer-led tours at SLR and PR • Dogs on Dike Trail continue to disturb wildlife

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
	• Closing the interpretive trail on the Columbia Dike (SLR) to horses, dogs, jogging, and bikes would improve the quality of wildlife viewing, increase safety and reduce crowding along the trail	and impact wildlife viewing • Kayak tours of Franz Lake would provide the only public access to this Refuge • Encourage wildlife viewing and photography at PR along existing trail (off-Refuge)	and impact wildlife viewing • Kayak tours of Franz Lake would provide the only public access to this Refuge
Opportunities for Wildlife Interpretation	• No change – status quo	• Entry sign and information kiosk on Dike Trail would communicate Refuge goals and management • Interpretation on State Route 14 at SLR overlook would reach wider audience with Refuge messages. • Interpretation on kayak tours of Franz Lake would increase public awareness of Refuge • Information kiosk on PR would increase visitor's understanding of the Refuge	• Same as Alternative B
Opportunities for Environmental Education	• Limited opportunity; local interest remains minimal and sporadic • Key Refuge "messages" not consistently communicated to students and teachers	• Program and facilities would provide consistent, high quality learning experience • Key Refuge messages communicated to students • Off-Refuge contacts encourage community involvement • Designated sites protect resources while providing quality learning opportunity	• Same as Alternative B, except rely more on volunteers than Refuge staff to operate educational program; results may be inconsistent
Opportunities for Non-Wildlife-Dependent Uses of Dike Trail	• Trail restrictions would eliminate opportunities; greatest impacts would occur in winter and if/when Refuge acquires private inholdings	• No change • If/when Refuge acquires private inholdings, equestrians and bicyclists connect to National Scenic Area	• Same as Alternative B

Issue/ Theme	Alternative A: No Action	Alternative B: Proposed Action	Alternative C
Effects on Outreach and Partnerships			
Public Outreach	• Minimal outreach to the public (and no Friends Group) may gradually increase awareness of the Refuges but not likely to gain widespread public support for its programs	• Increased outreach and signs would improve awareness of Refuges within local communities and for NSA visitors. • Friends Group would increase community involvement • Outreach would accomplish priority studies on Refuges	• Same as Alt B but with slightly more opportunities for community involvement in implementing Refuge projects
Partnerships	• Continue all existing partnerships to accomplish activities within Refuge boundaries	• Existing partnerships are enhanced and new partnerships established	Same as Alternative B
Effects on Cultural and Historic Resources			
Cultural and Historic Resource Protection and Interpretation	• Minimal increase in public use of Refuges would maintain low potential for disturbance of cultural and historic resources	• Potential for disturbance of cultural and historic resources would increase with greater public use • Pre-construction investigations would provide information to improve protection and interpretation	Same as Alternative B
Economic Effects			
Staffing	1 current FTE; 5 additional "essential staff" identified - contribute to local economy	Staff increase above "essential staff"- contribute to local economy	Same as Alternative B
Ecotourism	There would continue to be minimal impact on the economy until/if Gateway Center is constructed	Expected increase in public use of Refuges could increase tourism revenue to local towns and businesses	Same as Alternative B

References

1. Crone, E., and J. Gehring. 1998. Population viability of *Rorippa columbiae*: multiple models and spatial trend data. Conservation Biology, Volume 12(5), pages1054-1065.

2. Dunwiddie, W. 2002. "Status of *Rorippa columbiae* in the lower Columbia River." Personal communication, The Nature Conservancy, Washington State Field Office, Seattle, WA.

3. Habegger, E. P., W. Dunwiddie, and J. Gehring. 1998. Effects of river level on population dynamics of *Rorippa columbiae* on Pierce Island, Washington. The Nature Conservancy, Washington State Field Office, Seattle, WA.

4. Hays, D. W., K. R. McAllister, S. A. Richardson, and D. W. Stinson. 1999. Washington State recovery plan for the western pond turtle. Washington Department of Fish and Wildlife, Olympia, WA.

5. Paveglio F. L., and K. M. Kilbride. 2000. Response of vegetation to control of reed canarygrass in seasonally managed wetlands of southwestern Washington. Wildlife Society Bulletin 28(3), pages 730-740.

6. U.S. Army Corps of Engineers. 2000. Hydrologic analysis of Gibbons Creek basin, Steigerwald wetland, and industrial park: Planning and Assistance to States (PAS) study for the Port of Camas/Washougal; Washougal, Washington. U.S. Army Corps of Engineers, Portland District Office, Portland, OR.

7. U.S. Fish and Wildlife Service. 1999. Environmental Assessment, Steigerwald Lake Gateway Center, Steigerwald Lake National Wildlife Refuge, Washougal, Washington. Ridgefield National Wildlife Refuge Complex office, Ridgefield, WA.

8. U.S. Forest Service. 1992. Management plan for the Columbia River Gorge National Scenic Area. U.S. Forest Service, Hood River, OR.